

Claims:

1. Apparatus for pretensioning a tension-element drive powered by a drive motor with a rotary output shaft comprising, an initiation mechanism that selectively couples the torque of the output shaft to pretension the tension element.
- 5 2. The apparatus of claim 1 wherein said selective initiation mechanism is fully automatic.
3. The apparatus of claim 1 wherein said selective coupler is semi-automatic.
4. The apparatus of claim 1 where said selective initiation mechanism comprises a sleeve that extends axially over one axially extending section of the output
10 shaft and is operatively coupled for rotation with the shaft in only one direction, and a mechanical device that selectively blocks any rotation of the sleeve with respect to the shaft, and wherein the tension element is wound in one sense on said shaft and in the opposite sense on said sleeve, whereby, when the mechanical device is selectively activated, the motor overcomes the
15 previous pretension and rotates the shaft relative to the sleeve in the direction that increases pretension.
5. The apparatus according to claim 4 wherein said mechanical device comprises a solenoid.
6. The apparatus according to claim 4 wherein said mechanical device defaults to
20 being engaged when a tension element is not present.
7. The apparatus according to claim 4 wherein the mechanical device defaults to being disengaged when a tension element is not present.
8. The apparatus according to claim 4 wherein the mechanical device is engaged when said tension element unwraps from a location near a split between the
25 shaft and sleeve.
9. The apparatus according to claim 4 wherein the mechanical device is operated by the lateral motion of the tension element as the cable drive operates.
10. The apparatus according to claim 4 wherein said mechanical device comprises a thread or ball screw that drives a nut axially to initiate pretensioning.

11. The apparatus of claim 4 further comprising a rotary combination lock and wherein the output shaft drives the input to said combination lock mechanism allowing the pretensioning to be initiated at any drive location but only after the motor reverses its velocity in a specific sequence of precisely-
5 predetermined drive positions.
12. The apparatus of claim 11 further comprising a processor operatively coupled to said initiation mechanism when n velocity reversals are required to match the combination, and where said processor records the last $n-1$ velocity-reversal positions, and wherein said processor foils successful completion of
10 the combination by adding or subtracting a slight distance to any commanded velocity-reversal position that would otherwise complete the combination.
13. The apparatus of claim 11 in which the initiation mechanism includes a spring and trigger and wherein normal rotation of the motor immediately after a pretension event causes the spring to be compressed, so that it can be released
15 by the trigger when the proper combination-lock rotations are entered.
14. The apparatus of claim 1 further comprising torque control apparatus for the motor that sets the level of pretension.
15. The apparatus of claim 14 wherein said torque control apparatus comprises a controller for the winding currents powering the motor.
- 20 16. The apparatus of claim 1 further comprising an encoder and a processor that sense and save the last pretension position so that the degree of pretension actually added to the tension-element drive can be monitored.
17. The apparatus of claim 16 wherein the tension-element drive exhibits a capstan effect and the pretensioning apparatus operates to produce multiple
25 local pretensions in sequence alternating with running the drive over its full range at least one time.
18. The apparatus of claim 1 wherein the pretension that is set exceeds the ultimate desired pretension to reduce the number of local-pretensioning iterations to achieve the correct global pretension.

19. The apparatus of claim 1 further comprising means to measure pretension.
20. The apparatus of claim 19 wherein said measuring means comprises a strain gage.
21. The apparatus of claim 1 further comprising a processor operatively connected
5 at least to said initiation mechanism that runs neural-network algorithms that learn and adapt to individual users and applications
22. The apparatus of claim 21, wherein processor aids in the development of maintenance schedules automatically.
23. The apparatus of claim 21 wherein said process or transmits schedule and alert
10 information over a communications network.